

Further, in a printer disclosed in Japanese Patent Laid Open No. Hei 6-126981 (known example 2), a memory which memorizes a kind of cartridge, the residual ink amount, or the like rewritably is provided in the cartridge to mount a suitable cartridge in a recording device, and the residual ink amount can be grasped.

(0004)

(Problems to be solved by the Invention)

Though the printers disclosed in said respective known examples can actuate the recording device effectively, there are further left points to be improved.

(0005)

Namely, any ink cartridge mounted in the recording device is single, in which ink formation or the like is output only by single unit. Therefore, when a plurality of ink cartridges exist for objects of every uses, fitness among ink in the plural ink cartridges is not judged, so that there was disadvantage in print quality or the like.

(0006)

By the way, in a color printer which is recently used widely, the different kinds of ink, such as black, yellow, magenta, cyan, and the like are individually stored in each ink tank, and regarding the ink tank, a plurality of tanks are mounted to the printing apparatus, so that there is a remarkable tendency that there is convenience in exchange and maintenance of the tank.

(0007)

In this case, needless to say, not only each ink has characteristic fit for the printing apparatus desirably, but

also it is necessary for each ink to have the mutual fitness among ink in order to ensure the print quality of the like.

(0008)

In view of said present state, a first problem to be solved by this invention is to provide what can certainly judge ink fit for the printing apparatus, and to provide what can perform the printing operation of high quality and high reliability by judging the fitness among the different kinds of ink supplied from a plurality of tanks.

(0009)

A second problem to be solved by this invention is to provide what can perform a cleaning operation at a suitable timing without delay.

(0010)

A third problem to be solve by this invention is to provide what can exchange the tank at a preferable timing.

(0011)

(Means for solving the Problems)

Corresponding means in order to solve said respective problems are as follows:

(0012)

(1)A printing apparatus such as an ink jet printer, comprises a plurality of ink supplying means which can supply ink information and a controller for controlling at least a printing operation, wherein, when said ink supplying means is mounted on the printing apparatus, the mutual fitness among said plurality of ink information is judged and the printing operation can be controlled.

(0013)

(2) The printing apparatus described in said (1), wherein the control of said printing operation includes at least a stop instruction of the printing apparatus.

(0014)

(3) A printing apparatus such as an ink jet printer, includes a plurality of ink supplying means which can supply information of the residual ink amount, a controller for controlling at least a printing operation, and printing means or ink supplying means which can supply a preset minimum amount data of ink to the controller, wherein, when said ink supplying means is mounted on the printing means, a cleaning operation is instructed by comparing the said residual ink amount information with said preset minimum amount data of ink.

(0015)

(4) The printing apparatus described in said (3), wherein the cleaning operation is instructed, based on the less residual ink amount information of said plurality of residual ink information in the ink supplying means.

(0016)

(5) The printing apparatus described in said (3) or (4), wherein said cleaning operation is instructed when the residual ink amount is greater than a sum of the preset minimum amount of ink and ink amount required for the cleaning operation.

(0017)

(6) The printing apparatus according described in said (3) or (4), wherein the printing means is stopped when there is left ink within the ink supplying means, of which the residual amount is smaller than the sum of the preset minimum amount of ink and the ink amount required for the cleaning

operation, and then exchange of the ink supplying means can be instructed.

(0018)

(7) The printing apparatus described in said (3) or (4), wherein The cleaning operation which requires a small amount of ink up to the preset minimum amount of ink can be executed when there is ink within the ink supplying means, of which the residual amount is smaller than the sum of the preset minimum amount of ink and the ink amount required for the cleaning operation.

(0019)

(8) Ink supplying means for printing apparatus, wherein ink supplying means mounted to a printing apparatus such as an ink jet printer or the like includes at least a tank for storing ink therein, and a memory which memorizes ink information of the tank which includes adjustment information to another ink supplying means to be mounted to the printing apparatus.

(0020)

(9) Ink supplying means for printing apparatus, wherein ink supplying means mounted to a printing apparatus such as an ink jet printer or the like includes a tank for storing ink therein and a memory which memorizes residual ink amount information in a rewritable manner, and a preset minimum amount of the residual ink is also memorized, as ink information of the tank, readably from the printing apparatus.

(0021)

(10) Ink supplying means for printing apparatus, wherein ink supplying means mounted to a printing apparatus such as

an ink jet printer or the like includes a tank for storing ink therein and a memory which memorizes residual ink amount information, and ejecting amount of ink per dot at the printing time is memorized, as ink information, readably from the printing apparatus.

(0022)

(11) The ink supplying means for printing apparatus described in said (8) to (10), wherein a print head is mounted to said ink supplying means.

(0023)

According to the resolving means as described above, ink fitted to one another are supplied from a plurality of tanks in which ink which include characteristic fit for the printing apparatus are stored, and the printing operation of high quality can be carried out without trouble.

(0024)

(Embodiments of the Invention)

Embodiments of this invention will be described below referring to drawings.

(0025)

(Embodiment 1)

A first embodiment of this invention is characterized by the following points: In a recording device such as an ink jet printer or the like, ink supplying means for supplying ink to a print head includes a plurality of ink cartridges; a memory such as ROM or RAM in which ink information is memorized is mounted to each ink cartridge; ink have characteristic fitness among ink; and if ink fit for the printing means is not in a state capable of being supplied to the print head, the printing

operation can not be performed.

(0026)

That is, in the printing apparatus, in order to make printing of high quality possible and prevent some trouble, ink must be selected which has characteristics in viscosity, surface tension, properties of chemical matter or the like which fit the printing apparatus.

(0027)

Further, it is a important condition that ink supplied from a plurality of ink cartridges fit one another in mix colored characteristics, characteristics such as a chemical mutual action, or the like. As shown in Fig. 1, in printing means 100, there are provided a control section 10 which controls this printing means and is composed of CPU, a memory 20 for storing a control program for this control section 10 and ink data which fits the printing means 100 therein, an interface circuit 30 for receiving the print data or the like, an print controlling section 40 actuated by this control section 10, an operation panel 50 which operates manually this control section 10, and a display panel 60 for indicating a state of the control section 10. The memory 20 and the interface circuit 30 are connected to the control section 10 and the print controlling section 40 and the operation panel 50 are also connected to the control section 10.

(0028)

Further, a print head 41, a carriage motor 42, a paper feeding motor of a recording sheet 43 and cleaning mechanism 44 which are controlled by this print controlling section 40 are connected to the print controlling section 40.

(0029)

On the other hand, in ink supplying means 200, there are provided at least a first ink cartridge 210 and a second ink cartridge 220 which supply ink to the print head 41, and on their sides, there are provided first and second memories 230 and 240 which include ink information data therein and are composed of memory such as ROM or RAM. When the ink cartridges are mounted in a carriage (not shown) of the printing means 100, ink can be supplied to the print head 41 from the first and second ink cartridges 210 and 220. As shown in Fig. 3, contact means 250 and 260 are coupled to contact means(not shown)of a control section 10 to change information.

(0030)

Ink information data is any one, some, or all of data regarding a kind of ink showing data of properties of matter or the like such as color, a kind of dye, a kind of a pigment, component, viscosity or the like; and regarding structure of the ink cartridge such as effective ink amount, outer configuration, a kind of used member, structure or the like.

(0031)

For example, as shown in Fig. 3, the ink supplying means 200 comprises combination of two cartridges which are the first ink cartridge 210 for black ink (B) and the second ink cartridge 220 storing separately each ink (Y, M, C) of yellow, magenta, cyan.

(0032)

Then, the use operations of the printing apparatus and ink supplying means will be described with reference to a flowchart shown in Fig. 2.

(0033)

It is an indispensable condition that an ink passage including the print head 41 is so constructed as to fit ink(genuine ink) having the specific characteristic in order to obtain a printing result of high quality, and that the genuine ink is charged in the first and second ink cartridges 210 and 220.

(0034)

Accordingly, in the printing process as shown in Fig. 2, first, the first ink cartridge 210 is mounted in the carriage (not shown) (S1), or the second ink cartridge 220 is also mounted in the carriage similarly (S2).

(0035)

Hereby, the memories 1 and 2 are connected to the control section 10, and the respective ink information data  $D_1$ ,  $D_2$  are read by the control section 10 (S3, S4).

(0036)

Next, in the control section 10, ink data  $D_3$  from the memory 20 is compared with the ink information data  $D_1$ ,  $D_2$  (S5, S6).

(0037)

In result, if the ink information data  $D_1$  or  $D_2$  does not agree to the ink data  $D_3$ , ink which does not fit the printing means 100 is charged in any one of the first and second ink cartridges, or in both thereof, so that the printing means 100 is stopped, and its stopping is indicated in the display panel 60 and caution is given (S7, S8).

(0038)

If either of the first and second ink cartridges 210,



220 is fitted to the printing means 100 (that is, there is no problem in combination of data  $D_1$  and  $D_2$  ), then the mutual fitness between the first and second ink cartridges 210 and 220 is judged (S9).

(0039)

If ink in the first ink cartridge 210 does not fit ink in the second ink cartridge 220, the printing means 110 is stopped and its stopping is indicated in the display panel 60 (S10).

(0040)

Further, in case that the former ink fit the latter ink, a start of the printing operation is permitted, the print controlling section 40 is operated by the control section 10, and the print head 41, the carriage motor 42, the paper feeding motor 43 and the cleaning mechanism are on standby in a state capable of being started.

(0041)

A plurality of ink cartridges are prepared in relation to one printing apparatus, whereby several and optimum image outputs can be obtained by using one printing apparatus.

(0042)

For example, it is also useful that the ink cartridges are provided for each print medium (normal paper, special coat paper, cloth, canvas, or the like), and further, it is useful that the ink cartridges are provided for each required image quality (for indoor display or for outdoor display).

(0043)

However, when a plurality of ink cartridges are prepared and they are mounted on the printing apparatus, they must be

selected without error and be mounted in order to obtain the necessary image quality and reliability. According to the above embodiment, the wrong mounting can be previously prevented.

(0044)

For example, A simply example is shown in Fig. 8, in which ink cartridges X, Y for text printing and ink cartridges X', Y' for Photo printing are sold in relation to one printing means.

(0045)

Table 1

combination	judgment	caution
X , Y	O	for text printing, for general printing OK
X , Y'	X	tank unfitness
X' , Y	X	tank unfitness
X' , Y'	O	for photo printing OK

(0046)

As shown in Table 1, the ink cartridge Y is fitted to the ink cartridge X, and when the ink cartridges are mounted with other combination, unfitness is indicated to exchange any one of the cartridges.

(0047)

(Embodiment 2)

A second embodiment of this invention is characterized by a cleaning operation for removing air bubbles in a head pressure chamber, removing ink of which viscosity increases in a nozzle, removing paper dust attached to the nozzle and

scuffing, or the like.

(0048)

In a recording device such as an ink jet printer or the like, ink supplying means can install ink cartridges therein; each ink cartridge include RAM which memorizes rewritable ink information; and when the residual ink amount in any one of tanks is smaller than the ink amount necessary for the cleaning operation, the printing operation is stopped, or tank exchange is instructed.

(0049)

Namely, as shown in Fig. 4, in printing means 100a, a control section 10a composed of CPU for controlling this printing means is connected to a memory 20a which stores a control program for this control section 10a and ink amount data per one dot in the printing operation therein, and an interface circuit 30a for receiving the printing data or the like; a print controlling section 40a actuated by this control section 10a and an operation panel 50a for manually operating this control section 10a are also connected to this control section 10a; and a display panel 60a for indicating a state of the control section 10a is provided.

(0050)

Further, to the print controlling section 40a, a print head 41a, a carriage motor 42a, paper feeding motor 43a of a recording sheet, and cleaning mechanism 44a, which are controlled by this print controlling section 40a, are connected.

(0051)

On the other hand, in ink supplying means 200a, there

are provided a first ink cartridge 210a and a second ink cartridge 220a which supply ink to the print head 41a; first and second memories 230a, 240a for memorizing a kind of the ink cartridge, a kind of ink stored therein, and ink amount for use in printing are provided on side surfaces of the first and second cartridges; when the ink cartridge is mounted in a carriage (not shown) of the printing means 100a, ink can be supplied from a first tank 210a to the print head 41a; and as shown in Fig. 3, contact means 250a, 260a are connected to contact means (not shown) of the control section 10a to exchange the information.

(0052)

The first and second memories 230a, 240a are composed of readable and writable memories, and ink amount data is rewritten every time ink is consumed.

(0053)

In the ink cartridge in which yellow ink, magenta ink, and cyan ink are accommodated integrally, as shown in Fig. 3, the ink amount data of each color are memorized in one memory.

(0054)

Though the cleaning operation has been known in a lot of the conventional Published Unexamined Patent Applications, it will be further described referring to Fig. 10 which is a schematic view.

(0055)

In the cleaning operation, a recording head nozzle is closely capped with a suction cap and a pump communicated with the cap is driven.

(0056)

The recording head has a plurality of nozzles (regardless of nozzles which require the cleaning operation) for the respective colors of black, magenta, cyan, yellow and the like, and in the cleaning operation, ink is sucked from a partial nozzle or all the nozzles.

(0057)

Next, using operations of the printing apparatus and ink supplying means will be described referring to a flowchart shown in Fig. 5.

(0058)

This embodiment is characterized in that the cleaning operation is controlled according to residual ink amount information in the cartridge, in which the residual ink amount is smaller, of the first and second ink cartridges 210a, 220a. In the printing process shown in Fig. 5, the first ink cartridge 210a is firstly mounted in the carriage (not shown), or the second ink cartridge 220a is also mounted therein (T1).

(0059)

Hereby, the memories 1 and 2 are in liaison with the control section 10a, and the control section 10 reads data D<sub>1</sub>, D<sub>2</sub> each including the residual ink amount with a kind of ink cartridge and a kind of ink stored in the cartridges (T2).

(0060)

In this case, whether ink is charged by only the amount necessary for printing in either of the cartridges, or not is detected by comparing the residual ink amount therein with a preset minimum ink amount data D<sub>3</sub> from the memory 20a (T3); and if it is less than the minimum value, the operation of the printing means 100a is stopped and an ink end is indicated in

the display panel 60a (T4).

(0061)

However, if it is confirmed that sufficient amounts of ink are left in the first and second tanks 210a and 220a, then, the print information is provided according to an instruction by the operation panel 50a or through the interface circuit 30a, and an instruction is given to the print controlling section 40a from the control section 10a, so that the print head 41a, the carriage motor 42a, the paper feeding motor 43a or the like are respectively driven suitably to perform the printing operation. For this period, the printing state is indicated in the display panel 60a (T5).

(0062)

In result, the ink in the first and second ink cartridges 210a and 220a are thus consumed, however the amount of ink used for this printing is added to the amount of the ink used by dummy ink-ejection which is periodically performed to prevent ink viscosity of the nozzle portion from increasing (T6). Every time printing of one page is completed, its completion is informed of the memories 1 and 2, and the respective residual ink amounts are rewritten and memorized (T7).

(0063)

If the cleaning instruction is input during the printing operation or during print-stopping (T8), the cleaning instruction is given (T9), the residual ink amounts of the first and second ink cartridges 210a and 220a are read again (T10, T11), whether each residual ink amount is larger than a sum of the preset minimum amount of ink and an ink amount necessary for the cleaning operation and whether the cleaning operation

is possible or not are judged (T12, T13), and if it is possible, the cleaning operation is executed (T14).

(0064)

By the way, if the residual ink amount is less than the sum of the preset minimum amount of ink and the ink amount necessary for the cleaning operation, the cleaning is not executed to stop the printing means 100a and an ink end condition is displayed in the display panel 60a with respect to the first or second ink cartridge 210a, 220a which suffers the shortage of the residual ink amount (T15, T16).

(0065)

Then, whether the first or second ink cartridge 210a, 220a is exchanged is judged (T17, T18). If it is exchanged, the process goes back to Step T10 or T11 and thereafter the cleaning operation is executed when the residual ink amount is larger than the sum of the preset minimum amount of ink and the ink amount necessary for the cleaning operation.

(0066)

Another using method of the second embodiment shown in Fig. 6 is common in that the cleaning method is determined based on the information of the cartridge, which is smaller in the residual ink amount therein, of the first and second ink cartridges 210a, 220a, and in a flowchart of Fig. 6, steps T1 to T8 are the same as those in Fig. 5.

(0067)

Namely, when the presence or absence of the cleaning signal is judged (U9, T8) and it is judged that the cleaning operation is required, the residual ink amounts of the first and second ink cartridges 210a, 220a are read out (U10, U11)

and whether the residual ink amount of the first ink cartridge 210a is larger or smaller than that of the second ink cartridge 220a is judged (U12). If the residual ink amount of the first ink cartridge 210a is smaller, then whether the residual ink amount of the first ink cartridge 210a is larger than a sum of the preset minimum amount of ink and an ink amount necessary for cleaning or not is judged (U13). If the residual ink amount of the first ink cartridge 210a is smaller, the cleaning mechanism 44a performs a cleaning operation (U14) which requires the small ink amount up to the preset minimum ink amount of the first ink cartridge 210a (U14). If the residual ink amount of the first ink cartridge 210a is sufficiently larger, the cleaning mechanism 44a performs a normal cleaning operation which requires the normal ink amount (U15).

(0068)

Further, after a step U14, an ink end condition of the first tank 210a is displayed by the display panel 60a (U16) and then presence or absence of exchange of a new cartridge is judged (U17). If the ink cartridge is not exchanged to a new cartridge, the process is kept in the step U16 where the ink end is displayed. If it is exchanged, the process advances to a next step such as a recording operation.

(0069)

Regarding the second ink cartridge 220a, similarly, whether the residual ink amount of the second ink cartridge 220a is larger than the sum of the preset minimum amount of ink and ink amount necessary for cleaning or not is judged (U18). If the residual ink amount of the second ink cartridge 220a is sufficient, a normal cleaning is executed (U15), and if the



residual ink amount of the second ink cartridge 220a is smaller, a cleaning operation (U19) which requires the small ink amount up to the preset minimum ink amount of the second ink cartridge 220a is executed (U19).

(0070)

Further, if the residual ink amount of the second ink cartridge 220a reaches the preset minimum ink amount, this state is indicated in the display panel 60a (U20) and then presence or absence of exchange of a new cartridge is checked (U21).

(0071)

As described above, according to this embodiment, a plurality of ink cartridges are controlled so that the residual ink amount of even one ink cartridge of the ink cartridges is not less than the preset minimum ink amount.

(0072)

Namely, regardless of the cleaning instruction in relation to any cartridge of the first and second cartridges, in case that there is the ink cartridge which is short of the ink amount necessary for cleaning in relation to the preset minimum ink amount, the cleaning operation is stopped, the cartridge exchange is urged, and the cleaning is performed after the cartridge exchange; or after the cleaning operation which requires the only small ink amount up to the preset minimum ink amount is performed, then the cartridge exchange is urged.

(0073)

And, it is safely prevented that even ink in the head is sucked outside due to the resultant ink shortage during the

cleaning operation, thereby to effectively perform the cleaning operation.

(0074)

Regarding to the addition of the amounts of ink used by printing and dummy ink-ejection in the step 6, ink ejection amount per one dot which is a base of the addition is kept in the memory 20 of the printing means or in the respective memories 1, 2 of the first and second ink cartridges.

(0075)

In the former case, the control section 10 read out the ink ejection amount data per one dot according to the ink from the memory 20 based on the ink information read out from the first and second ink cartridges.

(0076)

In the latter case, the first and second ink cartridges themselves have the ink ejection amount data per one dot which is suitable for ink stored therein, and when their cartridges are mounted, its ink ejection amount data is read out by the control section.

(0077)

In the latter case, as it is not necessary to previously prepare a plurality of ejection amount data in the memory 201 of the printing apparatus, there is a advantage that the ink cartridge can be exchanged and used regardless of the data of the printing apparatus.

(0078)

The preset minimum value of the residual ink amount of each ink cartridge, as described before, is kept in the memory 20 of the printing means. However, in another embodiment, it

can be kept in the respective memories 1, 2 of the first and second ink cartridges.

(0079)

In the former case, the preset minimum values according to the ink cartridge information  $D_1$ ,  $D_2$  from the first and second ink cartridges are read out.

(0080)

On the other hand, in the latter case, the first and second ink cartridges themselves have respectively the preset minimum ink amount fitted thereto, and the preset minimum ink amount data are read by the control section 20 by mounting the ink cartridges to the apparatus.

(0081)

In the latter case, as the preset minimum ink amount is stored in the ink cartridge, there is an advantage that it can be set according to a kind and structure of the ink cartridge, a kind of ink, and the like.

(0082)

(Embodiment 3)

A third embodiment shown in Fig. 7 which is a block diagram is different from the first and second embodiments in that print heads 41b are integrally mounted in first and second tanks 210b, 220b. When ink in the tank is consumed, the print head is also exchanged integrally with the cartridge. As other parts are common to those in the first and second embodiments, they are only indicated on which the character b is put on.

(0083)

As a flowchart in a printing process is also common to that in Figs. 2, 5 and 6, its description is omitted.

(0084)

In the above-described apparatus, two cartridges are mounted, however more cartridges may be mounted. For example, as shown in Fig. 9 which is a modification of Fig. 3, even if the different ink cartridges (B, Y, M, C) for the respective colors of ink are provided, the similar effects can be obtained, needless to say.

(0085)

(Effects of the Invention)

The characteristic effects of this invention are as follows:

(0086)

(1) The ink cartridges are fitted to the printing apparatus and also have the mutual fitness between the ink cartridges which are different in kind, so that printing of high quality and high reliability is possible.

(0087)

(2) The cleaning operation can be timely performed.

(0088)

(3) The tank can be exchanged at good timing.

(BRIEF DESCRIPTION OF DRAWING)

(Fig. 1)

Fig. 1 is a block diagram of a first embodiment.

(Fig. 2)

Fig. 2 is a flowchart of the first embodiment.

(Fig. 3)

Fig. 3 is a perspective view of a tank of the first embodiment.

(Fig. 4)

Fig. 4 is a block diagram of a second embodiment.

(Fig. 5)

Fig. 5 is a first flowchart of the second embodiment.

(Fig. 6)

Fig. 6 is a second flowchart of the second embodiment.

(Fig. 7)

Fig. 7 is a block diagram of a third embodiment.

(Fig. 8)

Fig. 8 is an explanatory view of combination of tanks.

(Fig. 9)

Fig. 9 is a perspective view showing a modification of

Fig. 3.

(Fig. 10)

Fig. 10 is a schematic view of a cleaning device.

(Description of Symbols)

200(a, b)	ink supplying means
10(a, b)	control section
100(a, b)	printing means
210(a, b)	first tank
220(a, b)	second tank
230(a, b)	memory 1
240(a, b)	memory 2
41(a, b)	print head